

SUMMARY REPORT
OF THE
GEOLOGICAL SURVEY
DEPARTMENT OF MINES
FOR THE CALENDAR YEAR
1917.

PRINTED BY ORDER OF PARLIAMENT



OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1919

*To His Excellency the Duke of Devonshire, K.G., P.C., G.C.M.G., G.C.V.O., etc.,
etc., Governor General and Commander in Chief of the Dominion of Canada.*

MAY IT PLEASE YOUR EXCELLENCY,—

The undersigned has the honour to lay before Your Excellency, in compliance with 6-7 Edward VII, chapter 29, section 18, the Summary Report of the work of the Geological Survey, Department of Mines, for the calendar year ending December 31, 1917.

MARTIN BURRELL,
Minister of Mines.

To The Hon. MARTIN BURRELL,
Minister of Mines,
Ottawa.

SIR,—I have the honour to submit herewith the Directing Geologist's Summary Report of the work of the Geological Survey, Department of Mines, for the calendar year ending December 31, 1917.

I am, sir, your obedient servant,

R. G. McCONNELL,
Deputy Minister.

SUMMARY REPORT, 1917, PART A.

REPORT OF THE DIRECTING GEOLOGIST.

By William McInnes.

INTRODUCTION.

The operations of the Geological Survey during the season of 1917, though curtailed in some directions owing to enlistments for overseas service and reasons of economy in expenditure, covered portions of all the provinces of Canada. Special attention was given to the investigation of minerals that were required for war purposes and of minerals the supply of which was cut off or restricted by the war. The work of the geologists and topographers of the staff, and of the scientific and accessory divisions covering the fields of palæontology, mineralogy, biology, and anthropology is summarized in the following pages.

For the sake of greater economy in printing, the geologists' summary reports, which have in past years appeared in this report, have been published in separate sections arranged geographically, as described on the back cover.

GEOLOGICAL FIELD WORK.

W. E. Cockfield spent the field season of 1917 exploring portions of Sixtymile and Ladue River valleys, Yukon Territory. A short report by Mr. Cockfield covering this work has been published in Part B of the Summary Report for 1917. Placer gold was found in the gravels of Sixtymile district, three years before the Klondike discovery, and the district is by no means yet exhausted. The sulphide of mercury, cinnabar, is associated with gold in the gravels.

J. J. O'Neill was engaged during the summer in carrying out a detailed geological investigation of the mineral deposits of the district of Hazelton and northern British Columbia. The district included the mineral claims situated on Ninemile, Fourmile, Glen, and Rocher Déboulé mountains, and covering an area in all of 225 square miles, situated on the main line of the Grand Trunk Pacific railway. The part of the deposit lying to the north of Bulkley river contains chiefly silver-lead-zinc deposits, and copper and gold deposits mainly characterize the southern part. Ores of molybdenum and tungsten also occur.

Mr. O'Neill points out the advisability, in the case of properties situated as are the properties in this district, of a general co-operation among the various mine owners in the development of their properties with a view to the utilization of lower grade ores than would otherwise be possible and to secure the working of the deposits most economically.

Mr. O'Neill's report is published in Part B of the Summary Report for 1917.

Charles Camsell during the field season of 1917 examined the geology and mineral deposits along the line of the Pacific Great Eastern railway, between Squamish and Lillooet, B.C. Along this route, through the Coast range, occur large bands of stratified rocks which are mineralized along their contacts with the great bodies of granitic rocks forming the Coast range. Various ore deposits occur. No important developments have as yet taken place, but the whole district is fairly new and prospecting was only actively begun about three years ago. A report on this work, by Mr. Camsell, is contained in Part B of the Summary Report for 1917. In the same volume Mr. Camsell also gives a description of the copper-bearing deposits of Indian river which flows into Burrard inlet, about 25 miles from Vancouver. The information obtained

during his brief visit leads Mr. Camsell to believe that conditions are favourable for the occurrence of important bodies of copper ore. Mr. Camsell also made a hurried traverse of the Pacific Great Eastern railway beyond Lillooet, and in Part C of the Summary Report for 1917 gives an account of certain deposits of magnesite, diatomaceous earth and clay, occurring along the railway.

M. F. Bancroft spent the field season in the northern part of the Slocan district, in the Ainsworth and Trout Lake mining divisions, B.C. He also examined deposits of manganese in the vicinity of Kaslo and a gold mine near Silverton. Mr. Bancroft has published an account of his work in Part B of the Summary Report for 1917. Both primary and secondary deposits of the manganese occur on the northeast side of Kaslo Creek valley and the deposits are fully described by Mr. Bancroft, who also gives a general account of the gold, silver, lead, zinc, copper, and antimony ores of the southern Lardeau where, though mineral production as yet has been almost negligible when compared with other portions of Slocan district, there are many properties worthy of systematic prospecting and testing.

D. B. Dowling during the field season was engaged in special investigations in connexion with the development of the fuel and water resources of Alberta and Saskatchewan and in acting in a consultative capacity to companies engaged in developing the resources of these provinces. Mr. Dowling, with the assistance of S. E. Slipper and J. A. Allan, also engaged in delineating the outlines of a field in northern Saskatchewan and Alberta, possibly capable of producing oil and probably gas. Further reference to this work is given in connexion with the mention of the work performed respectively by Messrs. Allan and Slipper. Mr. Dowling states that the areas within which possibly an oil, and probably a gas field may exist, may be outlined as consisting of a belt extending from Saskatchewan, passing through the Viking field northwest to Athabaska river near Athabaska, and thence by a curved line to Peace river below Peace River Landing. A broadening of the belt northward from this line, in the Athabaska valley, seems to be indicated by the presence of oil in the McMurray formation. Mr. Dowling has published in Part C of the Summary Report for 1917, an account of the wells in southern Alberta being bored under contract by the Geological Survey for the purpose of demonstrating the extent of the area capable of yielding artesian water. In the same publication Mr. Dowling gives some information regarding the occurrence of potash in saline waters in Saskatchewan.

S. E. Slipper during the past season continued his work of systematically collecting and correlating the data obtained from drillings made in the search for oil and gas in Alberta. Mr. Slipper has published in Part C of the Summary Report for 1917, an account of the oil production of the Sheep River area. The light oils produced in this field are largely used for tractor fuels in the district. Five wells are producing oil and three stills have been installed to extract the gasoline and lighter distillates. During the field season Mr. Slipper engaged in the study of a portion of northern Alberta and Saskatchewan extending south from North Saskatchewan river to the Saskatoon-Calgary branch of the Canadian Northern railway and from a few miles east of the Saskatchewan-Alberta border, westward for a number of miles. The work was performed solely in an endeavour to determine the gas and oil possibilities of the area. A number of wells producing gas have already been sunk within the area and others are now being drilled. An account of some of the results obtained by Mr. Slipper is contained in Part C of the Summary Report for 1917.

J. A. Allan during the field season examined the geological sections exposed along the North Saskatchewan in the north, and Red Deer and South Saskatchewan rivers in the south. This work was undertaken as part of a general plan of work for the purpose of determining the possibilities, as a gas and oil-producing area, of the region in Saskatchewan and Alberta lying between the North and South Saskatchewan rivers and already alluded to in the notices of the work performed by Mr. Dowling and Mr. Slipper. A report by Mr. Allan on his work has been published in Part C of the Summary Report for 1917.

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A. E. Cameron during the field season of 1917, continued the exploratory and geological work begun in 1916 in the region adjacent to Great Slave lake. Mr. Cameron in Part C of the Summary Report for 1917 has given a statement of the results obtained by him and also has briefly indicated certain features affecting the probabilities of oil occurring in commercial amounts in the strata of the region.

Bruce Rose continued the mapping of a large area containing practically all the coal fields of eastern British Columbia and western Alberta in the mountains south of latitude 50 degrees. During 1917 he was engaged chiefly in examining the eastern edge of the Fernie basin. Mr. Rose has presented some of his results in Part C of the Summary Report for 1917 and shows that the area occupied by coal-bearing strata is considerably larger than was formerly known.

A. MacLean during the field season of 1917 commenced the mapping and examination of the coal-bearing area of the extreme southwestern part of Saskatchewan. A report by Mr. MacLean on part of this area is contained in Part C of the Summary Report for 1917. The territory examined is specially important since probably it will be the location selected for any briquetting and other experiments conducted on a commercial scale in connexion with lignite coals.

J. Stansfield during the field season of 1917 engaged in the examination of the surface deposits of the district west and south of Regina, the work being conducted with special reference to the question of underground water supplies. A report by Mr. Stansfield is contained in Part C of the Summary Report for 1917.

L. Reinecke during the year made an investigation of deposits of sand and gravel in the neighbourhood of Regina, Saskatchewan, for the purpose of ascertaining their suitability for concrete construction purposes and for road building. The report upon this work is being published as a separate memoir. Mr. Reinecke also supervised the work on road materials in eastern Ontario and Quebec and the laboratory tests necessary in connexion with the investigation.

E. L. Bruce was again engaged in field work in the rapidly developing mineral-bearing district of northern Manitoba, north of The Pas. The growing importance of the region necessitated Mr. Bruce devoting his attention solely to the Schist Lake district, in the western part of the region in the vicinity of the western boundary of the province. A preliminary report on the results of his work during 1917 has been published in Part D of the Summary Report for 1917. In this report, Mr. Bruce states that during 1917 one mine shipped 3,500 tons of ore containing 17 per cent of copper and points out that considering the adverse conditions of transportation, etc., the fact that so much has been accomplished in so short a time is an indication of what the country may produce under more favourable conditions. Mr. Bruce also paid a brief visit to certain claims staked for molybdenite in the vicinity of Falcon lake in southeastern Manitoba. In a report already published in Part D of the Summary Report for 1917, Mr. Bruce states that there is a possibility that these occurrences of molybdenite might, at the present time, be worked at a profit.

F. J. Alcock carried on field work in northern Manitoba in the Wekusko or Herb Lake district in which since the discovery in 1914 of gold-bearing quartz veins many prospects have been located, a considerable amount of development work done, and where on one property a mill is now being erected. In a report already published in Part D of the Summary Report for 1917, Mr. Alcock records the progress made in developing the gold-bearing properties of this district and calls attention to the occurrence of molybdenite and other minerals of economic importance.

J. R. Marshall spent the field season in southeastern Manitoba, examining certain districts in which gold-bearing deposits occur. In a report (published in Part D of the Summary Report for 1917), Mr. Marshall describes the general mode of occurrence and economic conditions governing the development of the gold-bearing quartz veins in the Long Lake, Gold Lake, and Star Lake districts.

W. A. Johnston during the past season made a soil survey of part of the area lying between lake Winnipegosis and Duck mountain in northwestern Manitoba. This

district includes a large area of land available for homestead entry and on account of its accessibility is important from the standpoint of land settlement. Practically the whole of the area is within 20 miles of the Canadian Northern railway and only a small part is occupied. Mr. Johnston also made a reconnaissance soil survey of the belt of land lying immediately along the Hudson Bay railway for 250 miles from The Pas to Limestone river. A full account of this reconnaissance is contained in Part D of the Summary Report for 1917 and in the same publication, Mr. Johnston gives the results of the tests made in connexion with samples of clay and sand obtained by him from the Swan River valley. The clay is of a semi-refractory nature and is probably the most useful clay discovered in Manitoba. The sand might be of value for glass mixing.

T. L. Tanton during the 1917 field season examined an area approximately 30 miles wide and extending for 130 miles along the Canadian Northern railway between Nipigon and Longuelac, Ontario. A report on this region by Mr. Tanton is contained in Part E of the Summary Report for 1917. Although there are no mines in this district and none of the observed mineral occurrences appear to warrant mining operations, yet there is a strong probability that valuable mineral deposits exist and that careful prospecting is warranted.

W. H. Collins spent the field season examining a number of small areas within 60 miles of Sudbury, Ontario, mainly for the purpose of estimating the character and probable importance of mineral deposits that have been found in these localities. Mr. Collins, in Part E of the Summary Report for 1917, has given an account of a number of these deposits. Several of the copper mines in the district bordering the north shore of lake Huron are again producing or are preparing to do so, and fresh attention is being given to a number of other properties. Gold-bearing quartz veins occur in the general region and in one part pegmatite dykes occur which in some cases might be profitably mined for feldspar and in others for mica.

H. C. Cooke explored an area in the district of Nipissing west of Montreal river for the purpose, mainly, of providing a guide to prospectors to belts of rock in which valuable minerals might be expected to occur. Mr. Cooke finds in the area explored the northern rim of the large area of Cobalt series rocks, which lies to the south; and to the north older rocks, including a basal igneous complex and an overlying sedimentary series. Intrusive granite and dykes of diabase cut the older rocks and sill-like bodies of peridotite occur which are in places altered to serpentine in which asbestos is found.

M. E. Wilson spent most of the field season of 1917 in the investigation of the geological and mineral deposits of a part of the Ottawa valley northwest of Ottawa. Onslow and Bristol townships in Quebec, and portions of Torbolton, Fitzroy, and MacNab townships in Ontario were examined and deposits of molybdenite and galena were investigated in some detail. The Port Elmsley graphite deposits in Lanark county were visited and their geological relationships studied. Considerable development has been done on the property of the Globe Graphite Mining and Refining Company, and Mr. Wilson describes at some length in Part E of the Summary Report, 1917, the character and extent of the deposits and their relationship to the Pre-Cambrian rocks which underlie the region.

M. Y. Williams spent the field season on geological work in connexion with problems bearing upon oil development in Halton, Wellington, and Kent counties, Ontario. As a result of the work Mr. Williams has attempted to indicate the structure and extent of various oil "pools," a description of which he has presented in Part E of the Summary Report for 1917. In the same volume, Mr. Williams also sets forth the results of certain lists of the oil-contents and fuel values of the shales outcropping at Kettle point, Lambton county.

Under the direction of Mr. Reinecke, Henri Gauthier carried out a survey of the materials suitable for road construction in the Montreal district. The area covered included the island of Montreal, isle Jesus, isle Bizard, and isle Perrot. The heavy

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traffic over the streets of a large city like Montreal, and on the roads approaching it, make it a matter of great importance that the most suitable and durable materials should be used in the construction of the roads.

Mr. Gauthier's investigation was made with the object of mapping all occurrences of bedrock, sandstone, and sand and gravel that are available in the district. It includes also laboratory tests upon the material. The results are given in a separate report which includes tables of deposits upon bedrock material, loose boulders, and sand and gravel aggregates.

R. H. Picher investigated and mapped materials suitable for road-making in a portion of Vaudreuil county, Quebec, and in the vicinity of St. Lawrence river, between the Quebec boundary and Cardinal, Ont. The materials dealt with are bedrock, mainly limestones, deposits of sand and gravel, and boulders which occur in aggregations and scattered sparsely over the general surface. Tests upon many of the dolomites and limestones of the deposit were made in the laboratory and analyses of the textures of the gravels and sands.

Mr. Picher's summary report is published separately.

R. Harvie spent the field season in the Thetford-Black Lake asbestos and chromite district. He devoted a part of his time to continuing the systematic examination of the general geology of this important area, and found confirmation of the direct relation existing between structural features and the occurrences of the asbestos and chromite deposits. The larger part of his time was devoted to a detailed examination of chromite deposits in order to be able to properly advise property owners in matters relating to prospecting and development work and thus to aid in increasing the production of this now much needed mineral.

G. A. Young spent the field season examining a district in the vicinity of a deposit of tungsten ore situated in central New Brunswick. A report of Mr. Young on the area examined is contained in Part F of the Summary Report for 1917. It is hoped that other deposits of tungsten ore may be found in this region.

E. R. Faribault continued the geological work already under way in Shelburne county. Special examinations were made of a number of properties which promised to yield minerals in demand for war purposes, including manganese and molybdenum deposits at New Ross, and tungsten deposits at Moose River. The summer's work was carried on principally, however, in the region about Lockeport where map sheet No. 110 of the Nova Scotia series of geological maps was completed.

A. O. Hayes worked mainly in Cape Breton county, in the southern part of the Sydney coal field, where concurrently Mr. Nichols carried on topographical work. Mr. Hayes reports in part on the geological structure of the area and describes the coal seams observed. He reports, also, upon a large deposit of pebbles that promises to be of importance for tube mill purposes. The results of tests of the pebbles are given. Manganese deposits at Loch Lomond, New Ross, and Pembroke are reported upon, together with molybdenite deposits at Gabarus bay and in Glengarry valley; iron ore at Grand Mira; zinc, copper, and lead at Stirling; argentiferous galena at Dunbrack; and feldspar and mica at Neils Harbour.

VERTEBRATE PALÆONTOLOGY.

L. M. Lambe devoted much of his time during the past year to the study and description of some of the many undescribed or little known forms of vertebrates included in our collections from the Belly River and Edmonton Cretaceous of Alberta. Specimens and collections of fossils received from officers of the Survey and from other sources have been determined and when necessary reported on. In the laboratory of the division, progress was made in the preparation of specimens for study and eventual exhibition, and G. F. Sternberg devoted his whole time to this work. C. M. Sternberg, besides engaging in work in the laboratory, also, during the field season, made a large and important collection of fossil remains from the Belly River beds of the Red Deer River valley, Alberta.

INVERTEBRATE PALÆONTOLOGY.

E. M. Kindle during the season of 1917 engaged in field work in the Great Slave Lake district, Northwest Territories. The primary object of this work was to secure more precise information regarding the order of succession of the formations and the co-ordinate problems of structure which are intimately related to the future economic development of the region. L. D. Burling during the field season studied various key sections in the Cordilleran region, east and west of the Columbia-Kootenay valley, in an endeavour to correlate the little known and largely unfossiliferous rocks of the Purcell and Selkirk ranges with the fossiliferous sections of the Rocky mountains. In the office, Messrs. Kindle and Burling studied and reported upon collections of fossils received from members of the Survey, this work forming a large part of the routine work of the division. All the time which could be spared from such routine work was devoted to research and to special pieces of work.

PALÆOBOTANY.

W. J. Wilson continued the study and cataloguing of the palæobotanical collections belonging to the Survey.

MINERALOGICAL DIVISION.

R. A. A. Johnston and his assistant Eugene Poitevin have carried on during the year the usual amount of mineralogical work. A very large number of specimens have been received during the year upon which reports have been made and advice given as to their composition and probable commercial value. In addition, many new Canadian mineral occurrences have been recorded. A beginning has been made in the establishment of an exhibit of economic minerals at 227 Sparks street. This will provide a place open to the public where a good display of the economic minerals of Canada may be made, and will largely fill the need that has been felt since the closing of the Mineralogical Hall at the Victoria Memorial Museum. A start has been made, also, in the same premises, in the fitting up of a laboratory which has been long needed for research work in mineralogy.

A great many valuable accessions have been made to the mineralogical collection during the year, mostly by donation, but a considerable number by purchase and exchange.

Under the supervision of A. T. McKinnon, the distribution of educational collections of minerals was continued to educational institutions throughout Canada that were in a position to use them to advantage.

TOPOGRAPHICAL DIVISION.

W. H. Boyd, chief of the division, supplies the following summary of the work of the staff:

Topographers from this division who are serving with the Canadian Expeditionary Force are: W. E. Lawson, S. C. McLean, A. G. Haultain, J. R. Cox, and E. E. Free-land.

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The following table shows the mapping work carried on during the field season by this division:

Locality.	Area in square miles.	Field scale.	Contour interval.	Topo- grapher in charge.
			Ft.	
Hazelton, British Columbia.....	225	$\frac{1}{62,500}$	100	F. S. Falcon- er.
Wainwright Sheet—Alberta— (Townships 38 to 46, ranges 5 to 10, west 4th mer.)	4600	$\frac{1}{125,000}$	100	A. C. T. Sheppard.
Monitor Sheet—Alberta and Saskatchewan— (Townships 30 to 40, ranges 1 to 5, west 4th mer.)				
(Townships 30 to 40, ranges 27 to 29, west 4th mer.)				
Canadian Northern Ontario Railway Exploration, Ontario.....	Route trav- ersing for control.	$\frac{1}{96,000}$	....	R. C. Mc- Donald.
Renfrew, Ontario	170	$\frac{1}{36,000}$	....	W. H. Boyd. K. G. Chip- man.
Chaudiere, Quebec.	100	$\frac{1}{48,000}$	20	B. R. Mac- Kay.
Sydney, Nova Scotia.	150	$\frac{1}{76,000}$	.....	D. A. Nichols

BORINGS DIVISION.

E. D. Ingall, chief of the borings division, reports that during the year the work of the division has continued along the lines heretofore followed. The work of collecting statistics of borings and cores, and records of wells has been carried on with the co-operation of the field geologists of the Geological Survey and covers all of Canada. The results for the year are summarized below:

Province	No. of bags sent out	No. of sam- ples received	No. of wells from which samples were received	No. of re- cords or part records re- ceived	No. of wells reported	No. of circu- lars sent out
Nova Scotia	102	0	0	12	13	3
New Brunswick	1,800	872	5	5	6	4
Quebec.....	111	44	2	2	5	18
Ontario.....	6,852	2,401	24	737	763	94
Manitoba.....	50	.....	.....	.....	.....	4
Saskatchewan.....	25	118	2	30	30	14
Alberta.....	200	74	6	20	20	8
British Columbia	200	25	2	2	2	6
Totals	9,340	3,534	41	808	839	151

BIOLOGICAL DIVISION.

Botany.

John Macoun continued during the year his botanical work on Vancouver island, giving his attention principally to fungi to which little attention had been given on the west coast before Mr. Macoun began to study them. With the assistance of Dr. John Dearness, of London, he has reported upon upwards of 1,000 packets of specimens, nine of the species being new to science. Mr. Macoun also made large collections of the flora of the island and a representative collection of 1,000 sheets was presented to the Provincial Museum at Vic-

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toria. A large collection of mosses and lichens was made and after determination these were sent to specialists in different parts of the United States for verification. All of the collections made by Mr. Macoun will be added to the herbarium of the Geological Survey.

James M. Macoun spent much time in the determination of specimens sent in by correspondents and collectors from all parts of Canada. Nearly 5,000 specimens were received in all. During the summer Mr. Macoun, assisted by William Spreadborough, made extensive collections in the region traversed by the Grand Trunk Pacific railway in British Columbia. In the neighbourhood of Hazelton the flora of the lower levels was found to be made up of a mixture of coast sub-Arctic forest and dry interior species, of which a large and valuable collection was made. In Jasper park about 500 species were collected within one day's walk of Jasper. Mr. Macoun's work in Jasper park was greatly facilitated by the kind co-operation of the park officials who gave him every assistance in his work.

Zoology.

R. M. Anderson, zoologist, gave his attention during the year to the study of the zoological material collected while on the Canadian Arctic Expedition and to the arrangement and classification of the extensive collection already in the possession of the Geological Survey.

P. A. Taverner spent the summer of 1917 in studying particularly the bird life of the western provinces of Canada, with the object of ascertaining their relative economic value. For this purpose he spent some time in the early part of the season in the neighbourhood of Shoal lake, Manitoba, and later in the season visited the region in the neighbourhood of Red Deer river in Alberta, and parts of British Columbia. With the aid of his assistant, C. H. Young, very large collections were made for the purposes of further study, and in order that the birds of the west might be more fully represented in our collections. Mr. Taverner also devoted much time to the study and classification of the extensive collections of bird skins already in the possession of the department.

Clyde L. Patch, and the preparatory staff of the division were engaged in preparing a number of bird groups for exhibition when space is available. Some of the groups have been placed on exhibition temporarily in one of the corridors of the Museum building. Large additions were made to the herpetological collection—twenty-two species being represented in the accessions. Much time has been also necessarily spent in preparing new skins so that they may be properly preserved, and in going over and protecting from destruction the large collection of stored specimens.

ANTHROPOLOGICAL DIVISION.

Ethnology and Linguistics.

Owing to economies enforced by the war no field work was undertaken by the division during 1917. The hall of Canadian anthropology in the Victoria Memorial Museum had again to be closed to the general public since the building was still occupied by the Dominion Legislature. A special exhibit of Indian handicrafts was, however, provided for the Central Canada Exhibition.

E. Sapir, C. M. Barbeau, and F. W. Waugh carried on research work and have published or have made arrangements for the publication of much of the results of their work in various journals and other publications of other institutions and societies. J. A. Teit could devote only part of his time during 1917 to the service of the Survey, but has contributed much anthropological and ethnological information relating chiefly to Indian tribes of southern British Columbia. D. Jenness prior to leaving

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for military service overseas was able to complete in finished form a substantial portion of the manuscript data collected among the Alaskan and Copper Eskimo.

Archæology.

The hall of archæology exhibits, as during the year 1916, remained closed to the general public and archæological field work has practically ceased. H. I. Smith with W. J. Wintenberg carried on various lines of research work. In addition, Mr. Smith has written the text of an album of archæological specimens found in Canada suitable as motives for distinctive Canadian decorative and symbolic designs and trademarks. A circular letter was sent to over 800 Canadian firms, drawing their attention to the material thus assembled and to the purposes to which it might be put, and in a number of cases further correspondence regarding the matter has ensued.

Physical Anthropology.

F. H. S. Knowles continued various lines of research work in connexion with physical anthropology.

PHOTOGRAPHIC DIVISION.

G. G. Clarke and his staff performed a very large amount of photographic work of a highly technical character during the year. This work embraced more than 17,000 negatives, prints, lantern slides, etc., required in the work of the various divisions of the Geological Survey. This division is a most essential one, particularly as an accessory to the work of the topographical and draughting divisions.

LIBRARY.

The small branch library established at the temporary offices of the Geological Survey, at 221 Wellington street, was continued in order that the members of the staff might have access to many books of reference that are in almost constant use and to the current mining and geological periodicals. This must be looked upon as only a temporary expedient since the need of a more free access to the full library is continually felt. The main library was continued at the Victoria Memorial Museum and was enriched during the year by the following accessions: books purchased, 249; books presented, 403; pamphlets received, 132; maps received, 82.

DISTRIBUTION DIVISION.

During the year 1917, 56,439 publications of the Geological Survey, exclusive of French editions, were distributed. Of these, 32,873 were distributed in compliance with written or personal requests and 23,566 were sent to addresses on the mailing lists.

MUSEUM.

Owing to the continued occupation of the Victoria Memorial Museum by Parliament the greater part of the exhibits of the National Museum are still in storage. Premises were, however, secured at 227 Sparks street, in which an exhibit of economic minerals was opened. This enabled the greater part of the mineralogical exhibits at the Museum to be opened to the public and allowed of the display of important collections illustrative of the economic minerals of Canada, and, especially, of those minerals which were in particular request for war purposes.

The series of various lectures already inaugurated in connexion with the Museum was continued, although it was necessary to carry on the work entirely in auditoriums

outside the Museum building. Thirty-two lectures were delivered by different members of the staff, mainly for educational institutions in Ottawa and its neighbourhood; but including also institutions in Quebec, Montreal, Toronto, and other cities.

GEOGRAPHICAL AND DRAUGHTING DIVISION.

C.-Omer Sénécal states that fifty-two new maps were printed and published during the past year, twelve other maps remaining in the hands of the King's Printer, for engraving or lithographing, and for printing. A set of six copper plates for a topographical map of Sandon area, British Columbia, were engraved by the office engraver, and there are at present in the office twelve new maps in various stages of compilation or preparation for reproduction. Two large-scale manuscript maps, were compiled to accompany a special report on road materials available for certain highways in Ontario. These maps were not intended for immediate publication. A large number of sketches, diagrams, sections, text-figures, and sundry drawings were also executed. Following is a list of maps which were in the hands of the King's Printer at the end of the year for engraving and printing, and a list of those which were published during the period covered by this report.

Maps in Hands of the King's Printer, December 31, 1917.

Series A.	Publication number.	Title.	Date of requisition.
132	1379	Rainy River district, Ont., Geology.....	June 15, 1916.
164	1581	St. John, N.B., Topography.....	March 14, 1916.
165	1582	Windermere, B.C., Topography.....	March 16, 1916.
174	1593	Blairmore, Alberta, Topography.....	March 29, 1916.
42	1192	Duncan sheet, B.C., Geology.....	Feb. 13, 1917.
44	1193	Sooke sheet, B.C., Geology.....	Feb. 13, 1917.
183	1630	Harricanaw-Turgeon basin, Que., Geology.....	May 30, 1917.
115	1336	Sheep river, Alberta, Topography.....	Aug. 10, 1917.
135	1391	Lower Churchill river, Man., Exploration.....	Sept. 14, 1917.
145	1495	Timiskaming county, Que., Geology.....	Sept. 14, 1917.
	1691	Buckingham, Que., Geology.....	Oct. 2, 1917.
	1708	Bridge river, B.C., Topography.....	Oct. 19, 1917.

Geological Survey Maps Published During the Year 1917.

Series A.	Publication number.	Title.	Remarks.
		<i>Yukon Territory.</i>	
60	1231	Wheaton; scale $\frac{1}{82,666}$	Geology.
151	1510	Nansen and Victoria creeks, Nisling river; scale 1 mile to 1 inch.....	Geology.
152	1541	Kluane lake; scale 4 miles to 1 inch.....	Geology.
154	1552	Southwestern Yukon; scale 8 miles to 1 inch.....	Geology.
		<i>British Columbia.</i>	
41	1191	Duncan sheet, Vancouver island; scale $\frac{1}{125,000}$	Topography, reprint.
157	1567	East Sooke, Vancouver island; scale 2,000 feet to 1 inch....	Topography.
166	1583	Portion of Flathead coal area, Kootenay district; scale $\frac{1}{62,500}$	Topography.
182	1629	Portion of Flathead coal area, Kootenay district; scale $\frac{1}{62,500}$	Geology.
167	1654	East Sooke, Vancouver island; scale 2,000 feet to 1 inch....	Geology.
	1666	Correlation sections showing structure of Kootenay terranes	Geology.
	1667	Slocan mining area, Kootenay district; scale 1 mile to 1 inch	Geology.

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Series A.	Publication number.	Title.	Remarks.
<i>Alberta.</i>			
57	1223	Frank landslide, 1903; scale $\frac{1}{8000}$	Topography.
	1604	Artesian water area, southern Alberta; scale 15 miles to 1 in.	Geology, reprint.
187	1645	Southern plains of Alberta; scale 8 miles to 1 inch.....	Geology.
	1646	View of model of southern plains of Alberta (from northwest)	Geology.
	1647	View of model of southern plains of Alberta (from southeast).	Geology.
	1668	Coal areas in the foothills, between Athabaska and Smoky rivers; scale about 16 miles to 1 inch.....	Geology.
	1669	Water, gas, and oil horizons in drilled wells of southern Alberta.....	Diagram.
<i>Alberta, Saskatchewan, and Northwest Territories.</i>			
186	1644	Tazin, Taltson, Slave, and Peace rivers; scale 8 miles to 1 inch.....	Exploration, geology.
<i>Saskatchewan and Manitoba.</i>			
	1692	Amisk and Athapapuskow lakes; scale 4 miles to 1 inch.....	Geology, preliminary edition.
<i>Manitoba.</i>			
	1670	Schist Lake district; scale 2 miles to 1 inch.....	Geology.
	1670	Schist Lake district; scale 2 miles to 1 inch.....	Geology, reprint.
	1671	Wekusko lake; scale 2 miles to 1 inch.....	Geology.
	1672	Gold-bearing deposits in the vicinity of Big Clearwater lake; scale $\frac{3}{4}$ mile to 1 inch.....	Geology.
<i>Ontario.</i>			
	1023	Corundum-bearing rocks of central Ontario; scale 18 miles to 1 inch.....	Geology, reprint.
161	1578	Beaverton sheet, Ontario, York, and Victoria counties; scale $\frac{1}{62500}$	Topography.
162	1579	Sutton sheet, York and Simcoe counties; scale $\frac{1}{62500}$	Topography.
163	1580	Barrie sheet, Simcoe county; scale $\frac{1}{62500}$	Topography.
168	1653	Deposits of stone and gravel available for a highway between Ottawa and Prescott; scale 2 miles to 1 inch.....	Economic geology.
179	1621	Onaping area, Sudbury and Timiskaming districts; scale 4 miles to 1 inch.....	Geology.
		Onaping area, Sudbury and Timiskaming districts; scale 4 miles to 1 inch.....	Topography, special advance edition.
180	1624	Espanola area, Sudbury district; scale 1 mile to 1 inch.....	Geology.
	1682	Lithological sections in the Beekmantown formation; scale 30 feet to 1 inch.....	Geology.
	1683	Lithological sections in the Chazy, Black River, and Trenton formations; scale 60 feet to 1 inch.....	Geology.
	1697	Explored routes in a belt traversed by the Canadian Northern Ontario railway, between Gogama and Missongia, Sudbury district (sheet 1); scale 4 miles to 1 inch.....	Geology.
	1698	Explored routes in a belt traversed by the Canadian Northern Ontario railway, between Oatland and Penhurst, Algoma district (sheet 2); scale 4 miles to 1 inch.....	Geology.
<i>Ontario and Quebec.</i>			
	1662	Ottawa, Carleton and Ottawa counties; scale 1 mile to 1 inch.....	Soils.
	1673	The Palæozoic rocks of lake Timiskaming and vicinity; scale 4 miles to 1 inch.....	Geology.

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	1657	Section showing distribution of vein matter, Montreal chrome pit.....	Diagram.
	1665	Stone available for road material, Hull to Grenville; scale 2 miles to 1 inch.....	Economic geology.
	1674	Magnesite deposits, lot 15, ranges IX and X, Grenville town- ship, Argenteuil county; scale 200 feet to 1 inch.....	Geological diagram.
	1674	Magnesite deposits, lot 15, ranges IX and X, Grenville town- ship, Argenteuil county; scale 200 feet to 1 inch.....	Reprint.
	1675	Magnesite deposits, lot 15, range XI, Grenville township, Argenteuil county; scale 200 feet to 1 inch.....	Geological diagram.
	1675	Magnesite deposits, lot 15, range XI, Grenville township, Argenteuil county; scale 200 feet to 1 inch.....	Reprint.
	1676	Pits in kaolin deposits, Amherst township, Labelle county; scale 200 feet to 1 inch.....	Geological diagram.
	1676	Pits in kaolin deposits, Amherst township, Labelle county; scale 200 feet to 1 inch.....	Reprint.
	1677	Coleraine, Megantic, and Wolfe counties; scale 1 mile to 1 inch.....	Geology and topography
	1679	Magnesite outcrops in Grenville township, Argenteuil county; scale 60 feet to 1 inch.....	Geological diagram.
		<i>New Brunswick.</i>	
63	1238	Moncton, Westmorland, and Albert counties; scale 1/2500..	Topography.
		<i>Nova Scotia.</i>	
	1678	Iron ore bed, Piedmont, Pictou county; scale 60 feet to 1 inch.....	Geology.
	1690	Whiteburn gold district, Queens county; scale 400 feet to 1 inch.....	Economic geology.

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PUBLICATIONS DIVISION.

Marc Sauvalle, chief of publishing and translating division, reports that the following memoirs, museum bulletins, and summary reports were published during the calendar year 1917:

English Reports.

1637. Memoir 91, Anthropological Series 14. *The Labrador Eskimo*—by E. W. Howley; pp. i-x, 1-235; plates, 35; figures, 32; map, 1; edition, 3,000 copies; published February 28, 1917.
1648. Memoir 93, Geological Series 78. *The southern plains of Alberta*—by D. B. Dowling; pp. i-ii, 1-200; plates, 35; figures, 3; maps, 3; edition, 4,000 copies; published May 5, 1917.
1651. Memoir 94, Geological Series 76. *Ymir mining camp, B.C.*—by C. W. Drysdale; pp. i-vii, 1-185; plates, 15; figures, 16; map, 1; edition, 3,500 copies; published March 15, 1917.
1655. Memoir 95, Geological Series 77. *Onaping map-area*—by W. H. Collins; pp. i-iv, 1-157; plates, 11; figures, 8; maps, 2; edition, 3,500 copies; published February 15, 1917.
1658. Museum Bulletin 25, Geological Series 34. *Recent and fossil ripple-mark*—by E. M. Kindle; pp. i-iii, 1-121; plates, 33; figures, 7; edition, 2,500 copies; published March 31, 1917.
1660. Memoir 96, Geological Series 80. *Sooke and Duncan map-areas, Vancouver island*—by C. H. Clapp, *With sections on the Sicker series and the gabbros of East Sooke and Rocky point*—by H. C. Cooke; pp. i-xi, 1-445; plates, 12; figures, 2; maps, 6; edition, 3,500 copies; published August 10, 1917.
1663. Museum Bulletin 26, Biological Series 6. *The flora of Canada*—by J. M. Macoun and M. O. Malte; pp. 1-14; plate, 1; edition, 3,000 copies; published March 10, 1917.
1664. Memoir 97, Geological Series 79. *Scroggie, Barker, Thistle, and Kirkman creeks, Yukon Territory*—by D. D. Cairnes; pp. i, 1-47; plates, 6; figures, 2; map, 1; edition, 3,500 copies; published May 28, 1917.
1684. *Summary Report of the Geological Survey, Department of Mines, for the calendar year 1916*; pp. i-ix, 1-419; figures, 12; maps, 13; edition, 5,000 copies; published August 14, 1917.
1685. Memoir 98, Geological Series 81. *Magnesite deposits of Grenville district, Argenteuil county, Quebec*—by M. E. Wilson; pp. i-iii, 1-88; plates, 11; figures, 2; maps, 3; edition, 3,000 copies; published July 24, 1917.
1687. Memoir 100, Geological Series 83. *The Cretaceous Theropodous dinosaur Gorgosaurus*—by Lawrence M. Lambe; pp. i-iii, 1-84; figures, 49; edition, 3,000 copies; published December 3, 1917.
1693. Memoir 101, Geological Series 84. *Pleistocene and Recent deposits in the vicinity of Ottawa, with a description of the soils*—by W. A. Johnston; pp. i-ii, 1-69; plates, 8; map, 1; edition, 3,500 copies; published September 29, 1917.

French Translations.

1040. Memoir 87, Geological Series 73. *Geology of a portion of the Flathead coal area, B.C.*—by J. D. MacKenzie; pp. i-ii, 1-53; plate, 1; figure, 1; maps, 2; edition, 1,000 copies; published August 23, 1917.
1051. *The Whitehorse copper belt, Yukon Territory*—by R. G. McConnell; pp. 1-63; plates, 2; figures, 2; maps, 8; edition, 750 copies; published May 29, 1917.
1236. Memoir 32, Geological Series 25. *Portions of Portland canal and Skeena mining divisions, Skeena district, B.C.*—by R. G. McConnell; pp. i-viii, 1-101; plates, 7; figures, 3; maps, 2; diagrams, 2; edition, 750 copies; published June 14, 1917.
1249. Memoir 34, Geological Series 63. *The Devonian of southwestern Ontario*—by C. R. Stauffer; pp. i-iv, 1-341; plates, 21; map, 1; edition, 1,500 copies; published June 28, 1917.

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1366. Memoir 40, Geological Series 24. *The Archaean geology of Rainy lake, re-studied*—by A. C. Lawson; pp. i-vii, 1-115; plates, 17; figure, 1; map, 1; edition, 1,500 copies; published March 28, 1917.
1367. Memoir 54, Biological Series 2. *Annotated list of flowering plants and ferns of Point Pelee, Ontario, and neighbouring districts*—by C. K. Dodge; pp. 1-131; figure, 1; edition, 750 copies; published October 10, 1917.
1371. Memoir 55, Geological Series 46. *Geology of Field map-area, B.C., and Alberta*—by John A. Allan; pp. i-vii, 1-312; plates, 36; figures, 5; map, 1; edition, 1,500 copies; published April 24, 1917.
1394. Memoir 56, Geological Series 56. *Geology of Franklin mining camp, B.C.*—by C. W. Drysdale; pp. i-vii, 1-246; plates, 24; figures, 19; maps, 2; edition, 1,500 copies; published April 17, 1917.
1442. Museum Bulletin 3, Geological Series 19. *Faunas of Anticosti island*—by W. H. Twen-
1446. Museum Bulletin 4, Geological Series 20. *The Crowsnest volcanics*—by J. D. MacKenzie;
1468. Museum Bulletin 5, Geological Series 21. *A Beatricea-like organism from the middle Ordovician*—by P. E. Raymond;
1477. Museum Bulletin 6, Anthropological Series 3. *Prehistoric and present commerce among the Arctic coast Eskimo*—by V. Stefansson;
1474. Museum Bulletin 7, Biological Series 4. *A new species of dendragapus from southern Yukon Territory*—by P. A. Taverner.
- These bulletins were published under one cover and contain: pp. 1-124; plates, 5; figure, 1; map, 1; edition, 1,000 copies; published August 23, 1917.
1469. Memoir 67, Geological Series 49. *The Yukon-Alaska International Boundary, between Porcupine and Yukon rivers*—by D. D. Cairnes; pp. i-iii, 1-160; plates, 16; figures, 2; maps, 2; edition, 1,500 copies; published June 12, 1917.
1464. Memoir 68, Geological Series 59. *Geological reconnaissance between Golden and Kamloops, B.C.*—by R. A. Daly; pp. i-vii, 1-375; plates, 48; figures, 4; maps, 7; edition, 1,500 copies; published June 24, 1918.
1466. Memoir 69, Geological Series 57. *Coal fields of British Columbia*—by D. B. Dowling; pp. i-iii, 1-360; diagrams, 23; map, 1; edition, 1,500 copies; published March 30, 1917.
1486. Memoir 72, Geological Series 60. *The artesian wells of Montreal*—by C. L. Cumming; pp. i-v, 1-160; plate, 1; figures, 5; map, 1; edition, 1,500 copies; published March 7, 1917.
1487. Memoir 73, Geological Series 58. *Pleistocene and Recent deposits of Montreal island*—by J. Stansfield; pp. i-iv, 1-75; plates, 3; figures, 10; maps, 2; edition, 1,500 copies; published November 22, 1917.
1488. Memoir 75, Anthropological Series 10. *Decorative art of Indian tribes*—by F. G. Speck; pp. i-ii, 1-75; plates, 13; figures, 23; edition, 1,000 copies; published June 7, 1917.
1506. Memoir 76, Geological Series 62. *Geology of Cranbrook map-area, B.C.*—by S. J. Schofield; pp. i-vii, 1-250; plates, 23; figures, 15; map, 1; edition, 1,500 copies; published November 8, 1917.
1511. Memoir 77, Geological Series 64. *Geology and ore deposits of Rossland, B.C.*—by C. W. Drysdale; pp. i-xi, 1-320; plates, 27; figures, 26; maps, 6; edition, 1,500 copies; published April 23, 1917.
1512. Memoir 79, Geological Series 65. *Ore deposits of the Beaverdell map-area*—by L. Reinecke; pp. i-v, 1-180; plates, 13; figures, 9; map, 1; edition, 1,500 copies; published October 4, 1917.
1534. Memoir 57, Geological Series 50. *Corundum, its occurrence, distribution, exploitation, and uses*—by A. E. Barlow; pp. i-v, 1-380; plates, 28; figure, 1; maps, 2; edition, 750 copies; published August 31, 1917.
1562. Memoir 81, Geological Series 67. *The oil and gas fields of Ontario and Quebec*—by W. Malcolm; pp. i-ii, 1-250; edition, 1,500 copies; published February 1, 1917.
1573. Memoir 82, Geological Series 68. *Rainy River district, Ontario. Surficial geology and soils*—by W. A. Johnston; pp. 122; plates, 12; figure, 1; map, 1; edition, 1,500 copies; published August 31, 1917.
1593. Memoir 41, Geological Series 38. *The Fern Ledges carboniferous flora of St. John, N.B.*—by M. C. Stopes; pp. i-vi, 1-180; plates, 25; figures, 21; edition, 750 copies; published July 5, 1917.
1617. *Summary Report of the Geological Survey, Department of Mines, for the calendar year 1915*; pp. i-viii, 1-310; figures, 3; maps, 8; edition, 1,500 copies; published March 5, 1917.

SESSIONAL PAPER No. 26

ACCOUNTANT'S STATEMENT.

By John Marshall.

The funds available for the work and the expenditure of the Geological Survey for the fiscal year ending March 31, 1917, were:

Details.	Grant.	Expenditure.
	\$ cts.	\$ cts.
Amounts voted by Parliament.....	571,312 50	
Civil list salaries.....		195,448 36
Explorations in British Columbia and Yukon.....		12,382 01
Topographical surveys in British Columbia.....		4,689 61
Explorations in Northwest Territories.....		34,747 92
Topographical surveys in Northwest Territories.....		10,751 83
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Topographical surveys in Ontario.....		3,744 22
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Explorations in general.....		3,896 58
Investigations of road materials.....		6,782 30
Ethnological investigations.....		3,328 91
Palæontological investigations.....		2,154 03
Arctic Expedition.....		4,909 42
Boring operations.....		1,260 00
Publication of reports.....		53,340 02
Translation of reports.....		4,997 78
Publication of maps.....		16,662 20
Wages, outside service.....		11,888 81
Stationery, mapping materials, sundry printing.....		5,973 50
Specimens for Museum.....		4,644 30
Miscellaneous.....		4,191 26
Library.....		2,690 10
Photo supplies.....		2,682 21
Postages and telegrams.....		1,619 38
Instruments and repairs.....		1,281 37
Cataloguing publications.....		1,200 00
Civil government contingencies.....		1,125 42
Advertising.....		472 54
Compensation to J. F. Lyons, in lieu of quarters, fuel, and light.....		400 00
Central Canada Exhibition.....		150 00
Balance unexpended and lapsed.....		151,160 91
	571,312 50	571,312 50

Summary.

	Grant.	Expenditure.	Grant not used.
	\$	\$	\$
Civil government appropriation.....	239,412 50	195,448 36	43,964 14
Explorations and surveys in Canada.....	185,000 00	112,596 20	72,403 80
Publication of reports and maps; translating.....	75,000 00	75,000 00	
Purchase of books, instruments, miscellaneous.....	54,000 00	30,937 31	23,062 69
Purchase of specimens for Victoria Memorial Museum.....	15,000 00	4,644 30	10,355 70
Compensation to J. F. Lyons for quarters, fuel, and light....	400 00	400 00	
Civil government contingencies.....	2,500 00	1,125 42	1,374 58
Casual Revenue.....	571,312 50	420,151 59	151,160 91
Sales of equipment.....		1,391 75	
Sales of publications.....		101 02	1,492 77

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